Learner Guide
Primary Agriculture

Evaluate Basic External Animal Anatomy and Morphology

My name: ..................................................
Company: ..................................................
Commodity: ...................... Date: ...............

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Before we start…

Dear Learner,

This Learner Guide contains all the information to acquire all the knowledge and skills leading to the unit standard:

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<td>NQF Level:</td>
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The full unit standard is attached at the end of this module. Please read the unit standard at your own time. Whilst reading the unit standard, make a note of your questions and aspects that you do not understand, and discuss it with your facilitator.

This unit standard is one of the building blocks in the qualifications listed below. Please mark the qualification you are currently doing:

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<td>National Certificate in Mixed Farming Systems</td>
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Please mark the learning program you are enrolled in:
Your facilitator should explain the above concepts to you.

You will also be handed a Learner Workbook. This Learner Workbook should be used in conjunction with this Learner Guide. The Learner Workbook contains the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed as part of your Portfolio of Evidence, which will be required during your final assessment.

You will be assessed during the course of your study. This is called **formative assessment**. You will also be assessed on completion of this unit standard. This is called **summative assessment**. Before your assessment, your assessor will discuss the unit standard with you.

Enjoy this learning experience!
How to use this guide …

Throughout this guide, you will come across certain re-occurring “boxes”. These boxes each represent a certain aspect of the learning process, containing information, which would help you with the identification and understanding of these aspects. The following is a list of these boxes and what they represent:

**What does it mean?** Each learning field is characterized by unique terms and definitions – it is important to know and use these terms and definitions correctly. These terms and definitions are highlighted throughout the guide in this manner.

**Activity**

You will be requested to complete activities, which could be group activities, or individual activities. Please remember to complete the activities, as the facilitator will assess it and these will become part of your portfolio of evidence. Activities, whether group or individual activities, will be described in this box.

**Examples**

Examples of certain concepts or principles to help you contextualise them easier, will be shown in this box.

**How am I doing?**

The following box indicates a summary of concepts that we have covered, and offers you an opportunity to ask questions to your facilitator if you are still feeling unsure of the concepts listed.

This guide is divided into sessions and each session relates to a specific outcome. You will participate in a number of learning activities that includes formal lectures / presentations, outings, classroom exercises and discussions.

The classroom feedback session on these activities will form part of the formative assessment. At the end of some sessions, a written questionnaire that tests embedded knowledge must be completed and handed to the facilitator as part of your assessment.

**My Notes …**

You can use this box to jot down questions you might have, words that you do not understand, instructions given by the facilitator or explanations given by the facilitator or any other remarks that will help you to understand the work better.
What are we going to learn?

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SAQA Unit Standard
What will I be able to do?

When you have achieved this unit standard, you will:

♦ Be able to visually evaluate animals externally with respect to their basic anatomical characteristics and morphological systems.
♦ Be well positioned to extend your learning and practice into other areas of animal production, ensuring efficient and effective animal production.
♦ Identify and name the class, species and type of animal according to criteria and under supervision.
♦ Identify and name the components and the externally visible divisions or parts of an animal and identify gross abnormalities therein.
♦ Understand the basic concepts of further anatomical systems within animals according to criteria.
♦ Identify and describe the morphological attributes of animals by which they are classified.
♦ Identify and describe the animal's life cycle.

What do I need to know?

No learning is assumed to be in place.

Learning Outcomes

You must be able to demonstrate a basic knowledge of:

♦ Applicable biological and morphological names and terminology.
♦ Applicable external characteristics and properties of animals and their components.
♦ Various applicable sensory cues regarding gross abnormalities in animals.
♦ The purpose of the anatomical, morphological and physiological evaluation of animals.
♦ Actions to be take in the event of various cues and symptoms being perceived during the evaluation of external anatomical, morphological and physiological parts of animals.
The appropriate codes of practice and procedures relating to the handling and evaluation of animals and the implications of contraventions.

The effects of the various gross abnormalities and their timeouts perception on the well being of the animal.

Classification of animals based on their anatomy and morphology.

Interpretation of information.

Use of Science and Technology.

Self-development skills.

You must be able to solve some problems independently, while other activities must be carried out as part of a team. You must be able to identify and interpret the information gathered.

To achieve this Unit Standard you will participate in a number of learning activities that include formal lectures and presentations, outings, classroom group activities and assignments.

The classroom feedback sessions on these assignments will form part of the formative assessment. At the end of this unit a written questionnaire that tests embedded knowledge and will form part of the summative assessment must be completed and handed to the facilitator. There will also be a summative theoretic test.

Introduction

All living things on our planet earth live in a very small space on the surface of the planet. Living creatures are found on land, in the air, as well as in the water covering the surface of the earth.

To make it easier to study the different living creatures on earth, scientists divided them into groups. The five groups in which they are divided are called kingdoms. They include:

- Monera (the prokaryotic bacteria and blue-green algae – which do not have nuclear membranes or subcellular organelles).
- Protista (unicellular algae and protozoans – single celled organisms).
- Plantae (multicellular plants).
- Fungi (non-photosynthetic plantlike organism – e.g. Mushrooms).
- Animalia (multicellular animals).
Two of the five kingdoms are very important for Agriculture: the Plant Kingdom and the Animal Kingdom. The purpose of this Unit Standard is to study the Animal Kingdom.

For the purpose of this Unit Standard the external anatomy (outside parts of the body) and morphology (the science of the forms and structures of organised beings) of the five Vertebrate (having a vertebral column) groups (classes) and three of the Invertebrate (any animal that has no spinal column) groups (classes) will be examined. The first two invertebrates are grouped together and are part of the so-called Arthropods (jointed legs). The third Invertebrate that we will look at is called mollusca, or animals with a soft body. The mollusca are a big group of soft-bodied animals that form the phylum mollusca with a few classes. One of the classes is the snail (Gastropoda).

It is necessary to study the anatomy and morphology of a few different animals to give you an understanding of the differences between animals and to show you what to look for when studying differences in animals. The different animals that are studied are easily available and illustrate the basic anatomic differences. It is not necessary for you to study every animal that is included, but the external anatomy that classifies an animal in a certain class must be explained.

In the agricultural world it is sometimes necessary to have knowledge of animals such as insects, fish, snails and reptiles. Snails, ticks and other insects are sometimes responsible for losses in small and large animal stock and can also destroy their fodder.

Other animals like fish and reptiles can also become a farming possibility.

Session 3 of this guide is very important because it will enable you to see the resemblance between farm animals and other animals in different classes.

**Vertebrate:** Is a subphylum of the Phylum Chordata comprising all animals that have a vertebral column (spinal column), including mammals, birds, reptiles, amphibians, and fish.

**Invertebrate:** Animal that has no spinal column.

**Arthropods:** Animals with jointed legs.

**Mollusca:** Animals with a soft body.
Session 1
Anatomy and Morphology of Vertebrate Animals

After completing this session, you should be able to:
SO 1: Identify and name the class, species and type of animal according to criteria and under supervision.

In this session we explore the following concepts:
There are five classes of Vertebrates (animals with a spinal column). Although they show large differences in their appearance and way of living, they are grouped together because they have a number of common characteristics.

Characteristics of animals with backbones:
♦ These animals have an internal skeleton of bone and cartilage (cartilage is a soft fibrous and flexible type of bone). Sometimes, as in the case of sharks, the entire skeleton is made of cartilage.
♦ All have a backbone or spinal column made up of vertebrae (back bones). That is where the group name “vertebrates” comes from.
♦ The heart is muscular and has 2, 3 or 4 chambers.
♦ The blood contains red blood corpuscles (specialised cells that are able to carry oxygen).
♦ All have a brain and a spinal cord. The brain, as well as the spinal cord, is protected by bones such as the skull and the back bones (vertebrae).
♦ All except the fishes breathe by means of lungs in the adult stage.

The five classes of Vertebrates
The five classes of vertebrates with examples of each class are:
1. Fish
   For example: Snoek, gold fish and sharks.
2. Amphibian
   For example: Frog, platanna.
3. **Reptiles**
   For example: Snake, lizard, chameleon, tortoise, and crocodile.

4. **Birds**
   For example: Cape Sparrow, chicken, ostrich, dove.

5. **Mammals**
   For example: Rabbit, dog, cat, sheep, cattle, whale, human.

### 1.1 Fish

Fish display a great variety of forms and are adapted to the environment in which they live in many ways. There are two groups of fish in the class that differs in the composition of their bones. These are the **bony fish** (fish with well developed hard bones) like the silver fish and galjoen and the **cartilaginous** (fish with soft flexible fibrous bones called cartilage) fish like the shark.

Fish serve as a major source of food to other living beings. Humans consume a lot of fish. Fish by-products are used in animal rations as a good protein source.

**External parts of a bony fish**

- **Body shapes**
  The shape of the body of a fish is well adapted for little resistance in water. This enables the fish to move quickly through water.

  The body of a fish is spindle (oval body that tapers down on both sides) shaped with the broader portion in front; and it is flattened on the sides. Although there are variations on the mentioned shape, the variations serve the individual most of the time to adapt to its immediate surroundings.

- **Body cover**
  The body cover of fish assists the animal to travel rapidly through the water. The skin develops **scales**. Scales reduce the resistance of the fish's movement through water.

  Large numbers of **mucous glands** occur in the skin of fish. These glands secrete mucus, which makes the body smooth and allows easy movement through the water medium. Even the **gill slits** (openings of the **gills**) assist with the movement of the fish through water.
Body divisions of fish

There are a lot of variations in the shape and size of fish. Even with these variations in mind, the body of a fish can be divided into a head, trunk and tail. No definite division can be seen between these parts. The head extends to the external gill slits; the tail begins just behind the external cloacae opening.

Illustration of a fish

- **The head**
  
  The external parts on the head are the following:

  - **The mouth**
    
    The mouth is situated on the front part of the head. Two movable lips can close the mouth.
- **The eyes**
  There are two eyes without eyelids, one on each side of the head. Each eye is covered and protected by a thin transparent epidermis (thin transparent skin).

- **The nostrils**
  Usually there are two external openings of the nose above the mouth. The nostrils are used for smelling. The sense of smell is well developed.

- **The gills**
  Between the head and trunk are two bony gill covers, one on each side. They cover the gills and protect them. The gills are the respiratory organs of the fish.

- **The trunk**
  The largest part of the body is the trunk and the following anatomical features can be distinguished.

  - **The cloacae**
    Both the digestive tract and the ureters (the ducts from the "kidneys") of the fish end in the cavity of the cloacae (external opening of the digestive and urinary tract). The opening is situated at the rear end on the underside of the trunk.

  - **The lateral line**
    The lateral (on the side) line extends on either side of the trunk of the fish. The lateral line serves as a gauge for the fish to orientate the fish according to its depth in the water.

  - **The fins**
    The fins of a fish represent the limbs of other vertebrate animals. There are two types namely, paired and unpaired fins. The fins serve as locomotor (help the fish to swim) organs.

    * **The paired fins**
      There are two pairs of paired fins:

      - **The pectoral fins**
        These fins are situated just behind the external gill slits on the side of the trunk.
- **The pelvic fin**
  They are found towards the lower surface of the trunk. Their position varies in different species but is usually situated below the pectoral fins. The function of the paired fins is to balance the fish. They also allow the fish to steer slowly through the water.

- **The dorsal fin**
  There is also an unpaired fin found on the trunk of the fish namely the dorsal fin. This prominent fin is found on the upper surface of the trunk.

- **The anal fin**
  The other unpaired fin is called the anal fin and occurs below the lateral line on the lower surface of the trunk.
  
  Both the dorsal and anal fins help to keep the body of the fish upright when it changes course in the water.

- **The tail**
  The trunk narrows gradually and then widens out again into an unpaired fin that forms the tail. This enlarged tail with a big surface plays an important part in the forward and other movements of the fish.

  - **Respiration**
    Fish breathe by means of their gills. The gills are situated on each side of the head. Four vascular (rich in blood vessels where the blood exchanges oxygen and carbon-dioxide) gills are found in each gill chamber on each side of the head.

    Water passes through the open mouth to the gill chambers and surrounds the gills. Gas (oxygen and carbon dioxide) exchanges between the water and the blood-filled capillaries (small blood vessels) within the gills. The water leaves the gill chambers through the gill slits covered by the gill covers on each side of the head.
Reproduction

Fish are unisexual (both male and female fish exist). The female lays eggs in the water and the male releases sperm into the water over the eggs. Fertilization occurs externally, that is: outside the body of the female. (The sun heats the water and the young fish emerge from the eggs on their own.)

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1.2 Amphibians

Animals that can live on land as well as in water

The amphibian is adapted to life both in water and on land. The most well known amphibians are various types of frogs and the Platanna. For the purpose of this study we will study the frog.

- The frog
  - The Body
    - The body lacks a neck and tail and has a hump on its trunk. The body is slightly flattened from top to bottom to make movement through the water easy.
  - Body covering
    - The skin of the frog is soft and naked and richly supplied with blood capillaries, which play an important role in the exchange of gasses through the skin. Mucus secreting glands ensure that the skin is always moist. Pigmented (coloured cells) cells also occur so that it is possible to change colour to blend into its surroundings.
The frog can change skin colour from darker to lighter tones (to make it less visible from its enemies and prey). The skin is only attached in certain places to the underlying muscles (the skin is used as a respiratory organ and is rich in blood vessels for the purpose of exchanging oxygen in the water).

♦ **Body divisions**

The frog has no neck or tail. A head and trunk can be distinguished, but there is no defined division between the regions.

![](image)

**Illustration of a frog**

- Head
- Eyes
- Mouth

♦ **The head**

The following features are found in the roughly triangular head:

- **The mouth**

  The mouth is on the anterior (front) end of the head. It is large and wide with a row of fine teeth on the upper jaw and no teeth on the lower jaw (fine teeth help to hold the prey before it is swallowed). The tongue is attached in the front and on the floor of the mouth and is loose at the back (the tongue can be unrolled and thrown out of the mouth to capture the prey). It is used to capture prey, mostly insects. The prey is swallowed whole.
• The eyes
Two large eyes are situated near the top of the head. Each eye has two movable eyelids and a membrane, which can move rapidly from the bottom to the top of the eye: it is like a third eyelid (This enables the frog to clean and protect the eyes from dirt and water).

• The ears
Just behind each eye there is an eardrum. The ears serve as hearing and balancing organs.

• The nostrils
Two nostrils lie at the front end of the snout. The nostrils are used for smelling and breathing.

♦ The trunk
The trunk forms the greater part of the body. It is flattened from top to bottom and the following are found on the trunk:

• The limbs
The fore limbs are short. They consist of an upper arm, a forearm and a hand with four fingers. The hind limbs are long and muscular and are made up of a thigh, a shin and a foot with five toes. A membrane extends between the toes. This assists the frog in swimming.

• The cloacae
The cloacae (external opening of both the digestive tract and urinary tract) are situated at the rear end of the trunk between the hind limbs.

■ Reproduction
The frog is unisexual (both male and female frogs exist). Females lay eggs in long strings in the water. The male then discharges sperm over them and fertilisation is therefore external (The sperm and eggs are outside the body when fertilization takes place).

■ Breathing
In the adult stage, the frog breathes primarily by means of two lungs, with limited help from the skin and the mucous membrane of the mouth.

♦ Lungs
Two external openings (nares) are linked by means of nasal passages to the mouth cavity and this gives rise to the pharynx (the part between the mouth, nares and throat), which leads in turn to the windpipe. The windpipe forks into two bronchi (branches of the windpipe) that lead to the lungs.
♦ **The mucous membrane of the mouth**

The mucous membrane of the mouth is moist and supplied with blood vessels where exchange of gasses takes place.

♦ **The skin**

The skin is thin and moist and contains many capillaries that enable the frog to breathe in water.

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1.3 Reptiles

A reptile is a cold-blooded animal which means that it is not capable of keeping its body temperature constant like the mammals and the birds.

This group of animals includes snakes, lizards, chameleons, crocodiles and tortoises. The lizard is a good example to study but any other species of reptile can be studied.

We will study the external anatomy of the lizard.

**Lizards**

- **Habitat**
  
  The lizard lives among stones, plants, and old trees. Some are well adapted to even live in very harsh circumstances like deserts. They are shy animals and live on insects. In winter they are inactive and spend this time in a well-sheltered environment. The best time to study them is during the warmer months.

- **Body**
  
  The body is elongated and slightly flattened from top to bottom.

- **Body cover**
  
  The skin has horny scales arranged like roof tiles. The scales on the head are larger and lie next to each other. They are called shields. The skin of the lizard is dry and is shed once a year. There are no glands in the skin.

- **The head**
  
  The head of the lizard is triangular and flattened from top to bottom. The following are found on the head:

  - **The mouth**
    
    The mouth is found on the front of the head and is broad. A single row of fine similar teeth occurs on both the upper and lower jaw. A long tongue is attached at the back of the mouth. Prey can be caught and held with the teeth before it is swallowed whole.

  - **The eyes**
    
    Large eyes occur on each side of the head with an upper and lower eyelid. There is also a membrane attached to the inner corner of the eye. It protects and cleans the eye of fine debris.
• **The ears**
  Behind each eye is a slightly sunken eardrum. They are used for hearing.

• **The nostrils**
  Two small nostrils are found at the tip of the snout just above the mouth. The nostrils are used for both smelling and breathing.

♦ **The trunk**
  The trunk is the broadest part of the body. The trunk narrows gradually into the tail. The following body parts are found on the trunk.

• **The limbs**
  They are short and attached to the sides of the body. The front limbs consist of an upper arm and a forearm with a hand with five fingers. The hind limbs consist of a thigh, a shin and foot with five toes. Both the fingers as well as the toes end in sharp claws.

• **The cloacae**
  The opening of the cloacae (external opening of the digestive and urinary tracts) is on the underside at the end of the abdomen.

♦ **The tail**
  The tail is cylindrical and gradually narrows to a point.

♦ **Reproduction**
  The lizard is unisexual and its fertilisation is internal (inside the body) after mating. The female lays a few oval white eggs, which are hatched by the heat of the sun. However, there are some lizards whose eggs develop inside the body of the female. When they are fully developed they are laid, and the young break through the thin enclosing membranes. These lizards are ovoviviparous (they develop in the mother and the eggs are laid and hatched outside the body).

♦ **Breathing**
  Lizards are animals that breathe through lungs.
How am I doing?

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1.4 Birds

Birds show a great variety in appearance, habitat and modes of feeding. They live in diverse habitats and some even migrate (travel long distances before winter starts to warmer areas) to escape bad climatic conditions. Birds vary a lot in size as well as habitat. Their habitats range from cold, Antarctic water, to the tropics. Some are adapted for living at sea, while others, like the ostrich, are adapted for hot, dry climates on land. Most birds’ fore limbs develop into wings and are used to propel the animal through the air. Some birds are true terrestrial animals and have lost the ability of flight. They live on land and sometimes on both land and water. Some birds develop an ability to swim well, like ducks.

There is a vast variety of birds. We shall study the pigeon as an example, because they are widespread and common.

The Pigeon

◆ Habitat

Pigeons are found wherever there is a place that provides sufficient cover for them. They are found in mountains, on rocky ledges, among buildings and in trees. They build simple nests with twigs.

◆ Body cover

The pigeon’s body is covered with feathers. The legs are covered with scales.
The feathers face backwards so that the bird has a nice rounded appearance.

The whole body of a pigeon and that of most of the birds that fly is shaped in such a way that it is streamlined to give as little resistance in flight as possible.

The body of a pigeon is shaped like a boat.

The Pigeon has different kinds of feathers, namely:

- **Quill feathers**
  The quill feathers are found on the wings and at the end of the tail. They enlarge the surface of the wing and tail. They help the animal to be able to fly. The feathers’ surface area is big compared to their weight.

- **Contour feathers**
  The contour feathers are similar to the quill feathers but are smaller. They help the bird to be streamlined and also conserve body heat.

- **Down feathers**
  They cover the young pigeon and help to conserve heat in the young pigeon. Down feathers play an important role in water-living birds to assist the other feathers in conserving heat.

- **Filo-plumes**
  They are fine and hair-like and occur under the quill and contour feathers. The bird uses these feathers to determine the direction of the quill feathers.
Different types of feathers

Different types of feathers are found on different birds. The circle at the left represents a magnified view of the surface of a contour feather, wherein interlocking barbules make up the fabric of the vane.

♦ **Body divisions**

The body consists of a head, a neck, a trunk and a tail.

- **The head**
  
  The head of most birds is small in relation to the body. In the pigeon the following anatomical parts are found on the head:

- **The beak**
  
  The jaws are elongated and toothless and covered with a horny sheath to form the beak. The shape of a bird’s beak is a good indication of the food it eats (see illustration). In pigeons the upper jaw curves downwards over the lower jaw enabling the bird to pick up seed.
Illustration of some of the different beak shapes of birds

- **The cere**
  On the upper surface of the beak at its base (where it joins the head) is a soft wax like, warty structure called the cere.

- **The nostrils**
  The nostrils are situated in the cere at the base of the beak - one on each side. The nose is used for breathing and smelling.

- **The eyes**
  They have large, round eyes on each side of the head. Each eye has two eyelids as well as a membrane, which is attached to the inner corner of the eye.

  The eyes of birds are very well developed and in birds like owls and eagles play a very important role in finding their prey. Owls use their eyes and ears to catch their prey in near darkness. Some birds can see more than 180° with one eye. That helps them in detecting prey or their own enemies.
• **The ears**

Just behind each eye, within the feathers, is the small opening of the external ear. The pigeon has a good sense of hearing.

Birds like the owl have an exceptional way of using its ears. The shape of the face directs the sound waves to the ear. Some of the owls’ left and right ears are on different levels - one on the upper part of the head and one on the lower part of the head. It enables the bird to determine accurately where his prey is in near total darkness.

• **The neck**

The neck is short and flexible, allowing the bird to rotate its head freely within a wide angle. Some birds can rotate their heads through 180°. That compensates for the little movement ability of their eyes. Some owls cannot move their eyes more than 2° - Humans can move their eyes 100°.

• **The trunk**

The trunk is large and boat-shaped and has the following features:

  o **The limbs**

    The fore limbs are modified to form wings. Although the wings are relatively small, the quills increase their surface area tremendously. The limbs or legs are attached high on the trunk.

  o **The cloacae**

    The opening of the cloacae is at the posterior (rear) end of the trunk.

  o **The tail**

    The tail is short, but the tail quills enlarge it. An oil gland opens near the tail. The bird spreads a film of the secretion from this gland with its beak onto the feathers to keep them waterproof.
Illustrations of the wing and feathers

♣ Reproduction

The pigeon, like most birds, is oviparous (lays eggs that hatch outside the body). The female lays two oval, white eggs. The hen (female) and the cock (male) take turns to sit on the eggs in order to keep them at a constant temperature. This is called incubation.

♣ Breathing

The pigeon uses lungs for breathing.
1.5 Mammals

Mammals are a very large group of animals. The mammals are found in a variety of places, on land, in fresh water, in seawater and some also have the ability to fly. They are found in the coldest areas of the world as well as the hottest and driest deserts. All breathe with lungs and feed their young in the early stage of life with milk. For a study on mammals, rats, rabbits or guinea pigs are the most suitable animals. We shall study the rabbit.

The entire body of the rabbit is covered with fine hair and coarse hair, which together forms a soft warm fur. The skin of the mammal contains sweat glands, which help to cool the body on hot days. Oil glands help to keep the fur soft and waterproof. Mammary glands produce milk in the female for suckling the young.

■ The Rabbit

♦ Habitat

Rabbits, as most of the other mammals that are suitable for study, are found in a variety of places on land. Rabbits and guinea pigs are frequently found in colonies.
Body divisions

The body is divided into four parts namely the head, the neck, the trunk and the tail. Some mammals, like the guinea pig, do not have a tail.

The head

The following are found on the head:

- **The mouth**
  At the front part of the head is a mouth, which can be closed by two fleshy and movable lips. The upper lip is split. On each side are a number of stiff hairs, which are the sensitive whiskers. Rabbits use their whiskers as a form of touch.

- **The nostrils**
  Two nostrils occur above the mouth and are used both for breathing and smelling.

- **The eyes**
  There are two eyes, one on each side of the head. Each has two eyelids and a movable membrane. The eyelids and the membrane protect the eye.
• **The ears**
  Behind the eyes are the two external openings of the hearing organs surrounded by a movable pinna (large oval shaped ear structure).

• **The neck**
  The neck is short and joins the head to the trunk.

♦ **The trunk**
  The following are found on the trunk:

  • **The limbs**
    The forelimbs consist of an upper arm, a forearm and a hand with five fingers, each of which ends in a nail.
    The hind limb comprises a thigh, a shin and a foot with four toes, each ending in a nail. There is a kneecap in front of the knee joint.

  • **The anus**
    The posterior (rear end) opening of the digestive tract is found at the rear end of the trunk.

  • **The tail**
    The tail is short in a rabbit or long in rats and mice. The guinea pig has no tail. Some mammals, like mice, use their tail during climbing. Some other mammals, like most of the primates, use their tails for balance and some even as an extra limb to help them in climbing trees.

♦ **Reproduction**
  Most mammals give birth to live young therefore they are viviparous (give birth to live offspring). The mother feeds the young on milk. Rabbits, rats and mice breed throughout the year.

♦ **Breathing**
  All mammals breathe by means of lungs.
Life-cycle of a rabbit

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Please complete Activity 1 in your learner workbook

My Notes ...

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In this session we explore the following concepts:

- In the previous session the vertebrates were discussed.
- Although they show marked differences in external structure they still have important characteristics in common.
- All the vertebrates have a vertebral column (spinal column) and an endoskeleton (skeleton inside the body). Not all animals are vertebrates.
- The other major group are the invertebrates. Two groups of invertebrate animals will be studied: the insects and the crustaceans that fall under the phylum (division) Arthropoda (a phylum of the animal kingdom comprised of organisms having a hard, jointed exoskeleton and paired joints and legs). The other group will be the Phylum Mollusca, or ‘soft-bodied’ animals.

### 2.1 Anthropoda

Unlike the vertebrates, the arthropods all have an external skeleton or exoskeleton (hard structure on the outside of the body). There are various kinds of exoskeleton, but all are made primarily of a non-elastic, waterproof substance called chitin. The exoskeleton can be very limiting, particularly with regard to movement.

Animals with exoskeletons never grow to any great size. It is known that three quarters of all known animals are Arthropods. Because they can adapt to a large variety of environments they are widely distributed in the world.

*Class: Arachnida*
We can distinguish five groups or classes of arthropods. There are more classes of arthropods but they are not important for the purposes of this study.

The following five groups are important and we will study two of them. The following main characteristics are mentioned for each of the five classes:

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<td>Head, thorax and abdomen</td>
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<tr>
<td>(insects)</td>
<td>Three pairs of legs</td>
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<tr>
<td><strong>Arachnida</strong></td>
<td>Cephalothorax and abdomen</td>
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<td>(spiders, scorpions, ticks, mites)</td>
<td>Four pairs of legs</td>
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<tr>
<td><strong>Crustacea</strong></td>
<td>Cephalothorax and abdomen</td>
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<tr>
<td>(crab, shrimp, rock lobster)</td>
<td>Five pairs of legs</td>
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<tr>
<td><strong>Diplopoda</strong></td>
<td>Head and body</td>
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<tr>
<td>(multipedes)</td>
<td>Two pairs of legs per segment</td>
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<tr>
<td><strong>Chilopoda</strong></td>
<td>Head and body</td>
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<tr>
<td>(centipedes)</td>
<td>One pair of legs per segment</td>
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Insecta

There are a big variety of species in this class. They can live almost everywhere on earth. They live in soil, water, on plants, in woods, in fruit, nearly anywhere that one can think of.

Insects like the honeybee and the butterfly are of great agricultural value because they assist farmers with pollination of their crops.

There are also destructive pests like the locust and fruit fly that fall in this class. An interesting feature of some species is the formation of social communities. This phenomenon can be observed in honeybees and termites and in some ants and wasps.

The Locust

The locust will be studied as a typical insect.
♦ **Habitat**

Locusts are land living insects. They feed on green plants and can cause great damage when they form big swarms.

A swarm consists of very large numbers of locusts.

♦ **Body division**

The body can be divided into three definite regions:

- The head
- The thorax and
- The abdomen.

♦ **The exoskeleton**

The body wall is the exoskeleton, which consists mainly of a waterproof, non-elastic substance called chitin. The exoskeleton is thin and hard except in a few specific places, namely between the segments of the abdomen and in the leg joints. Movement is possible at these points. Because the exoskeleton is non-elastic, the locust has to moult (shed) in order to grow.

♦ **The head**

The head is oval in shape and has the following features:

- **The antennae (feelers)**
  
  At the top of the head in the front is a pair of feelers. They serve as organs of touch and smell.

- **The eyes**
  
  Two large, compound eyes are very conspicuous: there is one on either side of the head. They enable the animal to distinguish between light and darkness and more importantly to see moving objects.

  Three simple eyes look like small black spots between the compound eyes - one on each side (above the base of each feeler), and one in the centre of the head.

- **Mouthparts**
  
  The locust has biting mouthparts and uses them to eat leaves and parts of plants.
♦ The thorax
The thorax is made up of three segments. The first segment (just behind the head) is called the collar. The following can be found on the thorax:

- The legs
  There are three pairs of legs. The biggest pair (rear legs) is used for jumping. The other two pairs of legs are used mainly for climbing to the perch when the locust is in a resting position.

- The wings
  Two pairs of wings are attached to the thorax. The first pair is narrow, hard and straight: they are joined to the second segment and in the resting position they lie parallel to the body.

  The second pair is thin, membranous and roughly triangular. They are folded under the first pair when the locust is at rest and are almost invisible. The second pair of wings is used for flying.

- The spiracles (holes used to breathe)
  Two pairs of breathing holes are found on the thorax.

♦ The abdomen
The abdomen is made up of clearly defined segments. The first segment of the abdomen is joined to the last segment of the thorax. Each of the following segments consists of an upper and a lower portion joined by a softer fold of chitin. In the female the abdomen ends in four pointed structures, which together form the ovipositor. The ovipositor is used both to make holes in sandy soil and to lay the eggs in the holes. The male is smaller than the female and its abdomen has a blunt end. The following structures are found on the abdomen.

- The tympanum
  An oval membrane can be seeing on the first segment. This is the tympanum, which helps the locust to hear.

- The spiracles (holes used to breathe)
  There are eight pairs of spiracles on the abdomen in all. They look like small black spots on the lower edge of the upper part of the abdomen.
The locust breathes through ten pairs of spiracles: two pairs on the thorax and eight pairs on the abdomen. From these openings a complicated system of air tubes (tracheae) extends throughout the body. If you observe a locust at rest, you will see the lower part of the abdomen moving up and down. In other insects like the honeybees, it is also very visible. These movements pump air in and out of the spiracles.

**Life cycle of the locust**

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2.2 Crustacea

The Crustacea are well known animals and spend most of their lives in water. They include animals like lobsters and crabs. We will study the crab.

### The Crab

#### Habitat

We find crabs in the sea and in various fresh water rivers, dams, pools and places where there is constant water.

#### Body divisions

The body of a crab is divided into two clearly defined regions, the cephalothorax (cephalo = head / thorax = chest - meaning the head and chest parts are one) and the abdomen (the part of the body that lies between the chest (thorax) and the beginning of the legs (pelvic area)). The abdomen is folded in under the cephalothorax. The crab has a calcareous (hard calcium rich) exoskeleton (hard structure on the outside of the body). The body wall is not hardened in certain areas and will allow little movement. Movement can take place at the joints of the legs and between the segments of the abdomen.

- **The cephalothorax**

  The head and thorax are fused together to form the cephalothorax that makes up the upper part of the body. It is broad and flattened from top to bottom. The upper part (surface) of the cephalothorax is covered with a shell like shield called the carapace.

  The following can be found on the cephalothorax:
  
  - **The antennae**

    In the middle of the cephalothorax at the front are one pair of long antennae and one pair of short antennae. They serve as organs of touch and smell.
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- **Eyes**
  On the outside of the 2 pairs of antennae is a short stalk with a compound eye at the tip. The stalks can fold into grooves in the carapace to shield them from damage.

- **The mouthparts**
  The crab has biting mouthparts - one pair of hard jaws, two pairs of soft jaws and three pairs of jaw-feet (maxillipodes - footlike structures of the upper jaw).

- **The legs**
  Five pairs of jointed legs are attached to the cephalothorax.
  
  The first pair is usually larger and stronger than the rest and end in strong pincers, which are used for holding the prey. The other four pairs end in strong claws and are used for movement.

- **Breathing gills**
  Crabs breathe by means of gills in a chamber on the side of the cephalothorax. In each chamber are six gills. They are structured so that the crab can live in and outside water.

- **The abdomen**
  In an adult crab the abdomen is permanently folded in under the cephalothorax. In the male the abdomen is roughly triangular, while in a female it is more dome-shaped. The abdomen consists of six clearly defined segments. If you lift it you will see the following:

  - **Swimmerets (peapods - long, flat reproductive structures covered with hairs)**
    These are long, flat structures covered in hairs. Two pairs occur in males and four pairs in females. They are used in reproduction. The anus is on the last segment.
The lifecycle of a lobster

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2.3 Mollusca (Phylum)

Animals belonging to this group are found on land, in the sea and in fresh water. The name Mollusca comes from the Latin word for “soft”. Most of the time they have a characteristic soft, glandular skin, which is covered by a protective shell. We shall study the garden snail.

The Snail

♦ Habitat

Snails are widely distributed. They cause great damage to cultivated plants on farms and in vegetable and flower gardens. Snails thrive during the rainy season.

♦ Body divisions

The body of the snail consists of a head at the front, a muscular foot below and a visceral (body where organs are situated) hump above.

The visceral hump contains the internal organs and is usually covered by a protective shell.

Illustration of a snail

The head

The head is situated at the anterior end of the muscular foot. At the front is a pair of long tentacles or feelers and a pair of short tentacles, which serve as organs of touch and smell. At the end of each long tentacle is a black eye, which enables the snail to distinguish between light and darkness. On the front of the head is the mouth in the shape of a “T”.
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The foot

The muscular foot is flat and large and makes up a large part of the body.

The visceral hump

Behind the head of the snail and above the muscular foot the visceral hump is situated. The internal organs are held together and protected by a thin, strong skin called the visceral sac. On one side this skin makes a fold known as the mantle. The part of the mantle, which projects beyond the rim of the shell, is thickened by a great number of glands and is called the mantle collar. The glands in it secrete gel. The breathing pore can be seen on the collar.

The skeleton of a snail

The snail has a hydrostatic skeleton: the body is kept firm by water pressure. Large spaces in the body are filled with watery liquid and the pressure of this liquid within the body makes the body firm and provides a skeleton for the muscles to work against.

Breathing pore in the collar

The snail breathes through its mantle. The cavity between the mantle and the visceral sac is called the mantle cavity and it is connected to the outside atmosphere by the breathing pore in the collar. Gaseous exchange occurs between the air in the mantle cavity and the blood in the mantle.

Lifecycle of snails

They lay eggs in damp soil that are later hatched. The small snails develop to adult snails in South-Africa in approximately 10 months and in other parts like California in America in up to 12 months.
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Please complete Activity 2 in your learner workbook

My Notes ...

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In this session we explore the following concepts:

♦ The importance to look at the basic external anatomy and morphology of some of the modern farm animals.

♦ The Poultry Industry is one of the biggest meat and egg producing industries in South Africa.

♦ If we look at the basic external anatomy of a chicken, there are big resemblances between it and the dove. Only very small differences exist like the cere on the beak of a pigeon and the comb on the chicken’s head. The main external organs like the wings and the general construction of the body are the same. The dove has a great ability to fly fast and effectively and therefore the body shape, the feather arrangement, the wing area compared to body mass and the size of the wing are different. The chicken has lost the ability to fly great distances. The body size and mass compared to the wing area is not favourable for flying.

♦ The chicken was developed through breeding programmes to produce meat and eggs and no attention was given in their breeding programmes to the ability to fly. Although a chicken’s external anatomy is still comparable to that of the bird class, their wings are under developed and thus they do not fly well.

♦ The farm animals that fall under the class Mammal are well known. Cattle, Sheep, Horses and Pigs are all examples of mammals. Although there are big differences between them, there are also basic anatomical resemblances between them.

♦ Through many years of selection (selecting the best milk producing cows) the dairy farmer developed the modern dairy cow. The modern dairy cow produces much more milk than her calf can use. The udder of the cow is also much larger than that of the original ancient cow. Most undomesticated (wild) mammals produce only enough milk to feed their young.
The body covering of a sheep also differs from the body covering of other farm animals. Some sheep, for example the Merino, have been bred for a thick and fine wool fleece. This wool fleece can be shorn and used for clothing by man.

We will study the basic external anatomy of the fowl and the sheep as examples of farm animals.

### 3.1 The Chicken

#### Chicken

##### Habitat

The chicken as a farm animal is not well adapted to the wild. Although it is farmed all over the world, it is mostly reared where shelter is available.

##### Body cover

There are very small differences between the body cover of a chicken and that of the pigeon.

The main difference is not so clearly visible but very important in that the feathers are not well-adapted to flight.

##### Reproduction

Like all the other birds, chickens are oviparous (lay eggs). Man uses the eggs of a large variety of birds as a commercial farming commodity. The ability to lay eggs on a daily basis for extended periods of time has been bred into domestic pullets (egg-laying poultry).
3.2 The Sheep

Sheep

The sheep is a well-known farm animal that falls under the mammal class.

Habitat

There are a large number of different sheep breeds. Some of them are very well adapted to different environments and therefore farmers farm with different breeds all over the world: From very dry areas like the Karoo to high rainfall areas like New Zealand. Sheep like the Merino with a dense wool cover, can withstand very hot, dry environments, yet they can also be comfortable in bitterly cold conditions.
Anatomic abnormalities that inhibit farm animals to produce normally

Farmers developed farm animals through the years as highly productive animals and it is therefore very important that the animal is healthy in order to produce.

It is important that farm animals are true to the breeding standards of the breed. Breed standards provide guidelines to farmers indicating the traits, which are important for production. Usually these breed standards discriminate against animals with large visible anatomical abnormalities (such as having 5 legs!). However, breed standards also assist in creating uniform animals that produce uniform carcasses for market, or uniform quality of product (such as wool or milk). Breed characteristics also discriminate against gross abnormalities, which may have an effect on production, such as a goat with an extra teat that gets in the way of the kid suckling from the functional teats.

Lifecycle of a sheep

Sheep are farmed all over the world. Their breeding seasons are usually determined by seasons, but may be manipulated by the farmer.

The mother (ewe) is mated to a ram and after approximately 150 days (5 months) a single lamb or up to four lambs (depending on the breed) are born. The mother suckles them on milk secreted from her udder for up to 5 months. After approximately 12 to 16 months (depending on the breed) the ewe lambs will reach puberty (puberty - stage were the hormones begins the sex cycle in the ewe). At this stage, the lambs can conceive and breed.

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Bibliography

Books:

Die lewensiklus van 'n padda - John Williams / “The life cycle of a frog” -
by John Williams

References: The World of Birds - Michael Corral; Birds of Southern Africa -
Kenneth Newman; Agred's Game birds of SA - P J Viljoen

"Die lewensiklus van 'n kony " - John Williams / “The life cycle of a rabbit” -
John Williams

"Die lewensiklus van 'n sprinkaan - Jill Bailey / “The life cycle of a locust “ - Jill
Bailey

Biology of Animals - Hickman, Roberts, Larson

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SOUTH AFRICAN QUALIFICATIONS AUTHORITY
REGISTERED UNIT STANDARD:

Evaluate basic external animal anatomy and morphology

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PURPOSE OF THE UNIT STANDARD

The learner achieving this unit standard will be able to visually evaluate animals externally with respect to their basic anatomical characteristics and morphological systems. In addition they will be well positioned to extend their learning and practice into other areas of animal production, ensuring efficient and effective animal production.

Learners will gain specific knowledge and skills in animal anatomy and physiology and will be able to operate in an animal production environment implementing sustainable and economically viable production principles.

They will be capacitated to gain access to the mainstream agricultural sector, in animal production, impacting directly on the sustainability of the sub-sector. The improvement in production technology will also have a direct impact on the improvement of agricultural productivity of the sector.

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

No learning assumed.

UNIT STANDARD RANGE

Anatomical systems include but are not limited to the following: external systems and covering, sensory systems, skeleton, musculature, nervous system, cardio-vascular system, digestive system, lymph, reproductive system and the endocrine and glandular systems. It is assumed that this learner operates under supervision.

Whilst range statements have been defined generically to include as wide a set of alternatives as possible, all range statements should be interpreted within the specific context of application.

Range statements are neither comprehensive nor necessarily appropriate to all contexts. Alternatives must however be comparable in scope and complexity. These are only as a general guide to scope and complexity of what is required.

UNIT STANDARD OUTCOME HEADER

N/A

Specific Outcomes and Assessment Criteria:
SPECIFIC OUTCOME 1
Identify and name the class, species and type of animal according to criteria and under supervision.

OUTCOME RANGE
This identification includes, but is not limited to fish, birds, mammals, insects, crustaceans, reptiles, molluscs and amphibians.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1
Animal nomenclature, class, type and gender are discussed, named and identified.

ASSESSMENT CRITERION 2
The specific animal is evaluated according to basic morphology and external characteristics.

ASSESSMENT CRITERION 3
The specific animal is classified according to the standard animal nomenclature.

SPECIFIC OUTCOME 2
Identify and name the components and the externally visible divisions or parts of an animal and identify gross abnormalities therein.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1
Animal main body parts are identified, named and understood.

ASSESSMENT CRITERION RANGE
Main body parts include but are not limited to external sensory organs and gross body parts such as head thorax, abdomen, back, as relevant to the context of application.

ASSESSMENT CRITERION 2
Animal appendages are identified, named and understood.

ASSESSMENT CRITERION RANGE
Appendages include but are not limited to legs, fins, horns, udders, antennae, feet, hooves, claws, wings, beaks, as relevant to the context of application.

ASSESSMENT CRITERION 3
Gross abnormalities are identified according to criteria.

ASSESSMENT CRITERION RANGE
Abnormalities include but are not limited to breaks, deformities, scarring and damage.

SPECIFIC OUTCOME 3
Understand the basic concepts of further anatomical systems within animals according to criteria.

OUTCOME RANGE
This description includes but is not limited to fish, birds, mammals, insects, crustaceans, reptiles, molluscs and amphibians, as relevant to the context of application.
Further anatomical systems include but are not limited to: external systems and covering, skeleton, musculature, digestive system and reproductive system.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1
Anatomical systems are named and their structure described.

ASSESSMENT CRITERION 2
The purpose of anatomical systems is briefly described according to criteria.

ASSESSMENT CRITERION 3
Portions of anatomical systems visible externally are identified and indicated.

SPECIFIC OUTCOME 4
Identify and describe the morphological attributes of animals by which they are classified.

OUTCOME RANGE
The morphological attributes of animals include but are not limited to the length, shape, size, angulations, thickness and other attributes of specific body parts of the animal.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1
Anatomical and body parts used for morphological evaluation are identified and shown.

ASSESSMENT CRITERION 2
Morphological attributes of various anatomical parts are described.

ASSESSMENT CRITERION 3
Animals are evaluated and classified according to morphological attributes.

SPECIFIC OUTCOME 5
Identify and describe the animal’s life cycle.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1
The various steps in the life cycle of the animal are identified.

ASSESSMENT CRITERION RANGE
This includes but is not limited to animals with complete life cycles or incomplete life cycles according to class.

ASSESSMENT CRITERION 2
The various attributes of the various steps in the life cycles are identified.

ASSESSMENT CRITERION 3
The reasons for the various steps in the life cycle and the vulnerability of the animal where appropriate are identified.
UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS

The assessment of qualifying learners against this standard should meet the requirements of established assessment principles.

It will be necessary to develop assessment activities and tools, which are appropriate to the contexts in which the qualifying learners are working. These activities and tools may include an appropriate combination of self-assessment and peer assessment, formative and summative assessment, portfolios and observations etc.

The assessment should ensure that all the specific outcomes; critical cross-field outcomes and essential embedded knowledge are assessed.

The specific outcomes must be assessed through observation of performance. Supporting evidence should be used to prove competence of specific outcomes only when they are not clearly seen in the actual performance.

Essential embedded knowledge must be assessed in its own right, through oral or written evidence and cannot be assessed only by being observed.

The specific outcomes and essential embedded knowledge must be assessed in relation to each other. If a qualifying learner is able to explain the essential embedded knowledge but is unable to perform the specific outcomes, they should not be assessed as competent. Similarly, if a qualifying learner is able to perform the specific outcomes but is unable to explain or justify their performance in terms of the essential embedded knowledge, then they should not be assessed as competent.

Evidence of the specified critical cross-field outcomes should be found both in performance and in the essential embedded knowledge.

Performance of specific outcomes must actively affirm target groups of qualifying learners, not unfairly discriminate against them. Qualifying learners should be able to justify their performance in terms of these values.

• Anyone assessing a learner against this unit standard must be registered as an assessor with the relevant ETQA.
• Any institution offering learning that will enable achievement of this unit standard or assessing this unit standard must be accredited as a provider with the relevant ETQA.
• Moderation of assessment will be overseen by the relevant ETQA according to the moderation guidelines in the relevant qualification and the agreed ETQA procedures.

UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE

The person is able to demonstrate a basic knowledge of:

• Applicable biological and morphological names and terminology.
• Applicable external characteristics and properties of animals and their components.
• Various applicable sensory cues regarding gross abnormalities in animals.
• The purpose of the anatomical, morphological and physiological evaluation of animals.
• Actions to be taken in the event of various cues and symptoms being perceived during the evaluation of external anatomical, morphological and physiological parts of animals.
• The appropriate codes of practice and procedures relating to the handling and evaluation of animals and the implications of contraventions.
• The effects of the various gross abnormalities and their timeous perception on the well being of the animal.
• Classification of animals based on their anatomy and morphology

UNIT STANDARD DEVELOPMENTAL OUTCOME

N/A
UNIT STANDARD LINKAGES
N/A

Critical Cross-field Outcomes (CCFO):

UNIT STANDARD CCFO IDENTIFYING
Problem Solving: Relates to all outcomes.

UNIT STANDARD CCFO WORKING
Teamwork: Relates to all outcomes.

UNIT STANDARD CCFO ORGANIZING
Self-Management: Relates to all outcomes.

UNIT STANDARD CCFO COLLECTING
Interpreting Information: Relates to outcome:
• Identify and name the components and the externally visible divisions or parts of an animal and identify gross abnormalities therein.

UNIT STANDARD CCFO COMMUNICATING
Communication: Relates to all outcomes.

UNIT STANDARD CCFO SCIENCE
Use Science and Technology: Relates to all outcomes.

UNIT STANDARD CCFO DEMONSTRATING
The world as a set of related systems: Relates to all outcomes.

UNIT STANDARD CCFO CONTRIBUTING
Self-development: Relates to all outcomes.

UNIT STANDARD ASSESSOR CRITERIA
N/A

UNIT STANDARD NOTES
N/A

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